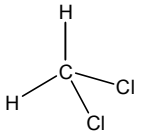
DICHLOROMETHANE (METHYLENE CHLORIDE)
CAS No. 75-09-2
First Listed in the *Fifth Annual Report on Carcinogens*



CARCINOGENICITY

Dichloromethane (CH_2Cl_2) is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (NTP 306, 1986). When administered by inhalation, the compound is carcinogenic in mice and female rats. It caused increased incidences of alveolar/bronchiolar neoplasms and hepatocellular neoplasms in mice of both sexes. Dichloromethane inhalation also increased the incidences of fibroadenoma of the mammary gland in female rats. There is some evidence of the carcinogenicity of dichloromethane in male rats, as shown by an increased incidence of fibroadenoma of the mammary gland (NTP 306, 1986; IARC S.7, 1987).

There are no adequate data available to evaluate the carcinogenicity of dichloromethane in humans identified (IARC V.20, 1979). The data from a study of 751 occupationally exposed workers also were considered inadequate to assess the carcinogenicity of dichloromethane in humans by later IARC Working Groups (IARC S.4, 1982).

PROPERTIES

Dichloromethane is a clear, colorless, nonflammable, volatile liquid with a sweet, pleasant, chloroform-like odor. It is slightly soluble in water, alcohols, phenols, aldehydes, ketones, and organic liquids. Dichloromethane is miscible with chlorinated solvents, diethyl ether, and ethanol. It will form an explosive mixture in an atmosphere with a high oxygen content, or in the presence of liquid oxygen, nitrite, potassium, or sodium. When heated to decomposition, it emits highly toxic fumes of phosgene.

USE

Dichloromethane is used principally as a solvent in paint removers (23% of the dichloromethane produced). It is also used as an aerosol propellant (20%); processing solvent in the manufacture of steroids, antibiotics, vitamins, and tablet coatings (20%); as a degreasing agent (8%); in electronics manufacturing (7%); and as a polyurethane foam blowing agent (5%) (Chem. Mktg. Rep., 1986b). Dichloromethane is also used in metal cleaning, as a solvent in the production of polycarbonate resins and triacetate fibers, in film processing, in ink formulations, and as an extraction solvent for spice oleoresins, caffeine, and hops (NTP 306, 1986; SRI Int., 1984). Dichloromethane was once registered for use in the U.S. as an insecticide for commodity fumigation of strawberries, citrus fruits, and a variety of grains (EPA, 1969).

According to the EPA Consumer Use and Shelf Survey, dichloromethane is used in spray shoe polish, water repellent/protectors, spot removers, wood floor and panel cleaners, contact cement, super glues, spray adhesives, adhesive removers (general purpose, tile and wallpaper),

silicone lubricants (excluding automotive), specialized electronic cleaners (for TV, VCR, razor, etc.), wood stains, varnishes and finishes, paint thinners, paint removers, aerosol spray paints, primers, aerosol rust removers, outdoor water repellents, glass frosting/artificial snow, spray lubricant for cars, transmission cleaners, battery terminal protector, brake quieter/cleaner, and gasket removers. The amount of dichloromethane present in these products varies both within and among product categories. Not all brands in a particular product category contain dichloromethane. In those products containing dichloromethane, concentrations vary from a low of 0.1% in several categories to a high of 100% in a paint stripper.

PRODUCTION

Moderate growth in the dichloromethane industry averaged about 3% annually from 1970 to 1983. With the trend towards manufacturing water-based aerosol spray systems that do not use dichloromethane. The demand declined an estimated 1 to 2% per year through 1990 (Chem. Mktg. Rep., 1986b). The US annual production in 1994 was 403 million lb. Consistent with this decreasing demand, imports of dichloromethane have declined from almost 60 million lb in 1985 to 25-27 million lb in 1988-1989 (ATSDR, 1993-R044). In the period 1991 to 1994 annual production was about 350 to 400 million lb. The EPA (OPPT) High Production Volume Chemicals list gives a production volume range of 365 to 651 million lb (USEPA, 1997).

EXPOSURE

The primary routes of potential human exposure to dichloromethane are inhalation and ingestion. Dermal absorption has been observed, although it occurs more slowly than absorption after ingestion or inhalation (NTP 306, 1986). The principle route of exposure for the general population to dichloromethane is inhalation of ambient air. Inhalation exposure may also occur through the use of consumer products containing dichloromethane such as paint removers, which results in relatively high levels being found in indoor air (ATSDR, 1993-R044; IPCS, 1996). In the surrounding air of rural and remote areas, concentrations between 0.07 to 0.29 $\mu g/m^3$ have been measured. In suburban areas, the average concentration is less than 2 $\mu g/m^3$, while in urban areas it is less than 15 $\mu g/m^3$. Near hazardous waste sites, levels up to 43 $\mu g/m^3$ have been recorded (IPCS, 1996).

Occupational exposure to dichloromethane occurs during production, primarily during filling and packaging. Because of its use in paint strippers, exposure also occurs during formulation of paint removers, original equipment manufacture, and in commercial furniture refinishing (IPCS, 1996). EPA has estimated that over one million workers are currently exposed to dichloromethane (NCI, 1987). The current threshold limit value (TLV) recommended by the ACGIH is 100 ppm as an 8-hr time-weighted average (TWA). The ACGIH has published a notice of Intended Changes for 1986-1987 to lower the TLV-TWA for an 8-hr workday from 100 ppm to 50 ppm (current TLV (ACGIH, 1996)) and to delete the short-term exposure limit (STEL) of 500 ppm (ACGIH, 1986; NCI, 1987). The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 2.5 million workers were potentially exposed to dichloromethane vapors (NIOSH, 1976). Based on health hazard evaluations of various U.S. companies conducted in 1973 and 1974 by NIOSH, the concentrations of dichloromethane to which workers might be exposed in the following occupations were determined: servicing diesel engines, 11 ppm; spray painting booths, 1 to 74 ppm; chemical plant, 0 to 5520 ppm with an 8-hr TWA of 875 ppm; ski manufacture, 0 to 36 ppm; cleaning foam heads, 3 to 29 ppm; cleaning nozzles in plastics manufacture, 5 to 37 ppm; plastic tank construction, several ppm. A 1973 study of occupational exposure to hair spray propellants

determined that dichloromethane exposure of beauticians exceeded a daily mean concentration of 1 to 2 ppm (IARC V.20, 1979). The use of dichloromethane in hair sprays has recently been banned by the FDA (ATSDR, 1993-R044). Based upon the data obtained in the EPA Consumer Use and Shelf Survey, the CPSC calculated average individual 45-year risks. They ranged from zero for some of the automotive products to highs of 409 per million for adhesive removers and 95 per million for paint strippers when the risk was based on malignant tumors in mice in the NTP bioassay; the risks were 924 per million for adhesive removers and 214 per million for paint strippers when the risks were based on malignant plus benign tumors in mice in the NTP bioassay (CPSC, 1987). The Toxic Chemical Release Inventory (EPA) listed 1,475 industrial facilities that produced, processed, or otherwise used dichloromethane in 1988 (TRI, 1990). In compliance with the Community-Right-to-Know Program, the facilities reported releases of dichloromethane to the environment which were estimated to total 127 million lb.

Dichloromethane occurs in surface water, ground water, finished drinking water, commercially bottled artesian well water, and surface water sites in heavily industrialized river basins. Higher levels of dichloromethane are usually found in groundwater, since volatilization is restricted. It was the sixth most frequently detected organic contaminant in groundwater from hazardous waste disposal sites in 1987 with a detection frequency of 19% (ATSDR, 1993-R044).

REGULATIONS

CPSC regulates household products containing dichloromethane, considering them to be hazardous and subjecting them to labeling requirements. EPA regulates dichloromethane under the Clean Air Act (CAA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Clean Water Act (CWA), Food, Drug, and Cosmetic Act (FD&CA), Resource Conservation and Recovery Act (RCRA), Superfund Amendments and Reauthorization Act (SARA), Safe Drinking Water Act (SDWA), and Toxic Substances Control Act (TSCA). EPA has published water quality criteria under CWA and established a reportable quantity (RQ) of 1,000 lb for dichloromethane under CERCLA. This chemical is exempted from a tolerance for residues, and is regulated as a toxic inert ingredient of pesticides under FD&CA. Dichloromethane is a listed hazardous substance under RCRA. EPA has included dichloromethane on a list of priority hazardous substances under SARA. Further regulatory testing is proceeding under TSCA. FDA regulates dichloromethane as a limited food additive. Specified residues are permitted in spice oleoresins, hops extract, and decaffeinated coffee. NIOSH recommends that exposure be reduced to the lowest feasible concentration. OSHA has adopted a permissible exposure limit (PEL) of $\leq$ 500 ppm as an 8-hr TWA and a 1,000-ppm ceiling. It has issued an Advanced Notice of Proposed Rulemaking to revise the PEL. OSHA also regulates dichloromethane under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table B-42.